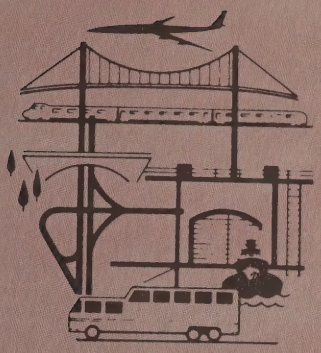
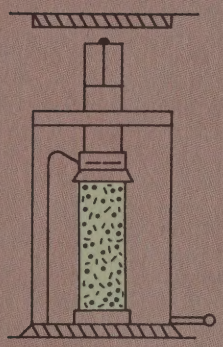
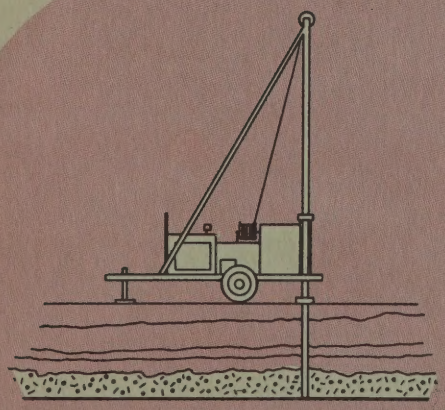
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

RAYMOND T. SCHULER, COMMISSIONER

SOIL MECHANICS BUREAU







THE USE OF MANPOWER-PRODUCTION REPORTS AS A MANAGEMENT TOOL

June 1977

SM 238b (1/73)

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE June 16, 1977

SUBJECT MANPOWER-PRODUCTION DATA REPORT
FOR COMMISSION ON MANAGEMENT AND PRODUCTIVITY

FROM Lyndon H. Moore, Director, Soil Mechanics Bureau, Room 102, Bldg. 7 R.H.M.

TO Gilbert H. Priess, Management Improvement Bureau, Room 101, Bldg. 4

cc Wm. P. Hofmann, Technical Services Subdivision, Room 210, Bldg. 7A

In response to your recent request for information on the use of manpower-production data in the management of the Soils Program we have prepared the attached report entitled, "The Use of Manpower-Production Reports as a Management Tool" which summarizes our experiences over the past twelve years.

The Soils Program provides services to all other Department programs in the areas of earthwork and foundations for transportation facilities. The program involves about 2-1/2 percent of the Department's manpower (290 people). Staffing size and operating budgets are dictated by fiscal policy at the State level and program policy at the Department level. Manpower-production data has been useful for manpower planning, performance evaluation, budget preparation, and cost effectiveness analysis.

The report includes a description of the Soils Program and a summary of our experience with manpower-production data as a management tool. We have attempted to keep the presentation brief. However, we will be pleased to provide additional information or clarification if you desire.

LHM:MR
Attachment

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THE USE OF MANPOWER-PRODUCTION REPORTS AS A MANAGEMENT TOOL

Lyndon H. Moore, Director
Soil Mechanics Bureau
New York State Department of Transportation
State Campus, Albany, New York 12232

June 1977

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SOILS PROGRAM

MISSION STATEMENT

Organization and staffing are developed to meet goals and objectives of the program. Function codes are developed to describe manpower activities required to perform the work. The function codes are recorded on bi-weekly attendance reports (AD 73) by each employee to provide manpower activity data.

The Soils Program described on the following pages includes six major activities -

Explorations
Testing
Analysis and Design
Construction
Specifications and Standards
Management and Support

STATEMENT OF MISSION
SOILS PROGRAM
DEPARTMENT OF TRANSPORTATION

Soils Program

The "soils" program in the Department of Transportation implements the Department goals and objectives in the areas of earthwork and foundations for transportation facilities by the effective application of the principles and techniques of earth engineering. Earth Engineering includes the broad subject areas of earthwork engineering and foundation engineering and utilizes various disciplines including soil mechanics, rock mechanics, engineering geology, soil science and geophysics.

The program responsibilities are to provide adequate technical services for all phases of project development and to develop and improve technical standards in the area of Earth Engineering.

PROGRAMS & ACTIVITIES	GOALS & OBJECTIVES	FUNCTION CODE
EARTH ENGINEERING EXPLORATIONS All activities connected with terrain reconnaissance and subsurface exploration and sampling to acquire data pertaining to the nature, extent and engineering characteristics of soil and rock formations.	1) To perform adequate exploration activities within the deadlines imposed by the Department Program schedule. 2) To obtain adequate data for the evaluation and solution of potential earthwork, foundation and rock problems involved with the transportation program. 3) To improve the efficiency of operations by conducting technical training; developing and evaluating more efficient exploration equipment and procedures.	E100 SERIES E101 Borings-State Forces-Engineering E102 Borings-State Forces-2½" Drill Holes E103 Borings-State Forces-4" Drill Holes E104 Borings-State Forces-Hand Auger Holes E105 Borings-State Forces-Retractable Plug Sampler E106 Probings-State Forces E107 Test Pits-State Forces E108 Borings-State Forces E109 Borings-State Forces-Flight Auger Holes E110 Borings-Contract-Engineering E111 Moving Exploration Equipment E112 Equipment Maint. & Repair-Drilling E133 Rock Outcrop Mapping & Map Preparation E135 Bore Hole Camera Surveys-Field E136 Bore Hole Camera Surveys-Analysis E137 Bore Hole Camera Surveys-Equip. Maint. E138 Geophysical Surveys-Field-Seismic E139 Geophysical Data Analysis & Reports E140 Geophysical Equip. Maint. & Repair E151 Terrain Reconnaissance-Highway Project E152 Terrain Reconnaissance-Design Problem E153 Terrain Reconnaissance-Airport Project

PROGRAMS & ACTIVITIES	GOALS & OBJECTIVES	FUNCTION CODE
EARTH ENGINEERING TESTING All testing activities essential to the preparation of foundation analyses and designs and for construction control of earthwork items.	1) To perform adequate testing necessary for analysis and design meeting all deadlines imposed by the Department Programs schedules. 2) To perform testing necessary for quality assurance control of all earthwork items in the construction program.	E200 SERIES E201 Identification Tests-Disturbed Samples E202 Identification Tests-Tube Samples E203 Classification Tests E204 Strength Tests-Routine E205 Strength Tests-Special Procedures E206 Consolidation Tests E207 Permeability Tests E208 Frost Effect Tests E221 Granular Materials Test-Field & Lab E222 Compaction Tests-Field & Lab E223 Top Soil Tests-Field & Lab E224 Stabilization Tests E225 Laboratory Equipment Maint.
EARTH ENGINEERING ANALYSIS AND DESIGN All activities involved with the design of soils features in the transportation system, including pavements, bases, subbases, shoulders, surface and subsurface drainage, earth and rock cut slopes, embankments, embankment foundations, tunnels, dams, structure foundations, soil aspects of culvert and pipe design, and surveys for available earth materials for construction.	1) To perform necessary activities within scheduling requirements of Department programs. 2) To provide adequate design solutions to all earthwork engineering problems that will satisfy the criteria of economy, efficiency and adequate performance. 3) To assure that all necessary soils features and considerations are incorporated into the contract plans and specifications according to the technical standards of the soils program.	E300 SERIES E301 Roadway Design-General E302 Airport Design-General E311 Roadway Foundation Design E312 Bridge Foundation Design E313 Retaining Wall Foundation Design E314 Culvert and Pipe Foundation Design E315 Building Foundation Design E316 Canal Foundation Design E317 Dam Foundation Design E318 Review of Dam Designs of Others E131 Geologic Surveys & Analysis-Rock Cut Slopes E132 Geologic Surveys & Analysis-Structures Foundations

PROGRAMS & ACTIVITIES	GOALS & OBJECTIVES	FUNCTION CODE
EARTH ENGINEERING CONSTRUCTION All activities concerned with Transportation projects under construction involving the solution of earth and rock problems and quality assurance control of earthwork items.	To provide prompt and adequate technical services in earth engineering for the proper solution of all soils and rock problems arising during the construction of Department projects.	E400 SERIES E401 Roadway Inspection-General E402 Airport Inspection-General E411 Roadway Inspection-Foundations E412 Roadway Inspection-Bridges E413 Roadway Inspection-Retaining Walls E414 Roadway Inspection-Culverts & Pipes E415 Roadway Inspection-Stabilized Materials E416 Roadway Inspection-Geologic E417 Roadway Inspection-Stone Filling and Rip-Rap E418 Construction Control Instrumentation E421 Building Inspection E422 Canal Inspection
SPECIFICATIONS & STANDARDS All activities concerning the development and preparation of specifications and standards for exploration, testing, design, construction and quality assurance.	To continually evaluate and monitor earth engineering construction specifications and standards, design and construction standards and procedures, field and laboratory test methods, making such changes as are necessary to improve economy, performance and efficiency.	E500 SERIES E501 Earthwork E502 Culverts and Pipes E503 Explorations E504 Pavements E511 Performance Evaluations-Projects Planning & Development E512 Performance Evaluation-Data Collection E513 Laboratory Testing E514 Performance Evaluation & Data Analysis E515 Performance Evaluation & Report Prep.

PROGRAMS & ACTIVITIES	GOALS & OBJECTIVES	FUNCTION CODE
MANAGEMENT AND SUPPORT All activities concerned with the management of the Bureau programs and the internal support services for the conduct of these programs.	1) To develop and monitor the policies, programs and procedures for the achievement of the Bureau's goals and objectives. 2) To provide the support services for the efficient operation of the Bureau programs. 3) To develop recommended staffing patterns for the Regional Soil Sections by December 1970. 4) To continually develop the professional competence of the engineers and technical ability of the technicians by a coordinated training program.	MANAGEMENT 0110 Administration 0330 Budget SUPPORT 0121 Clerical, Secretarial, Typing 0131,2 On-the-Job Training- Student, Instructor 0134,5 Bureau School-Student, Instructor E612 Communication of Technology with Professional Groups

SOILS PROGRAM ORGANIZATION

The Soils Program consists of the Soil Mechanics Bureau (120 people) in Albany and a Soils Section in each of the ten Region offices (total of 170 people).

Figure 1 shows the location of the Bureau and the Region Soils Sections in the Department Organization Chart.

Figure 2 shows the Bureau Organization Chart. The Bureau is organized into eight sections by specialized activity. The Region Soils Sections have soils engineers, technicians, and two to five drill crews, depending on the size of the Region design and construction program.

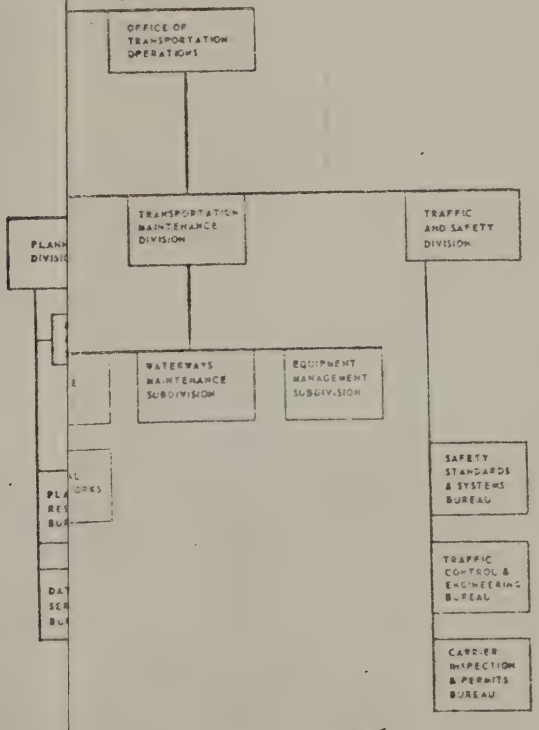
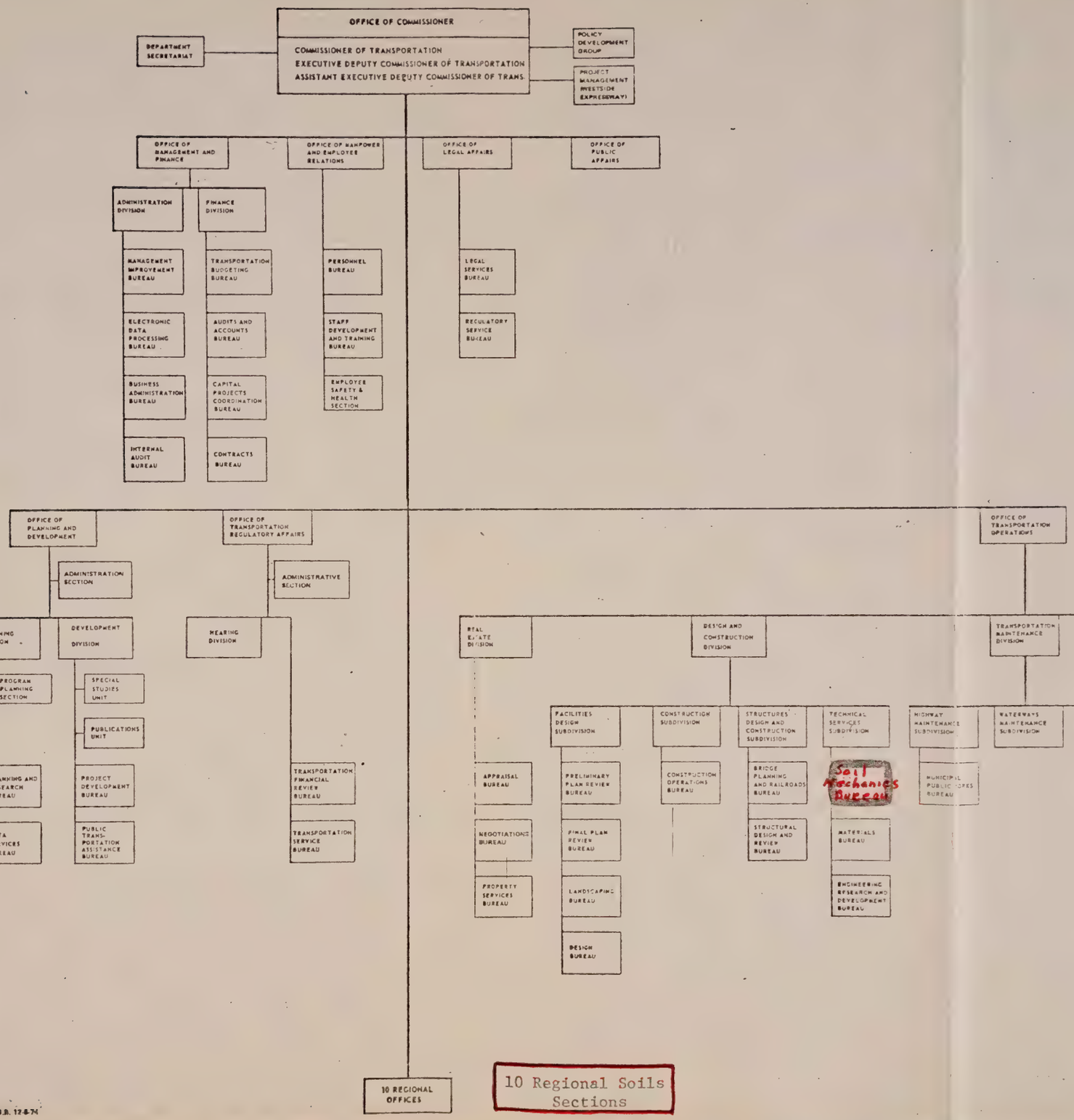

OFFICE OF TRANSPORTATION OPERATIONS
TRANSPORTATION MAINTENANCE DIVISION
TRAFFIC AND SAFETY DIVISION
WATERWAYS MAINTENANCE SUBDIVISION
EQUIPMENT MANAGEMENT SUBDIVISION
SAFETY STANDARDS & SYSTEMS BUREAU
TRAFFIC CONTROL & ENGINEERING BUREAU
CARRIER INSPECTION & PERMITS BUREAU

FIGURE 1

NEW YORK STATE

DEPARTMENT OF TRANSPORTATION

ORGANIZATION CHART



10 Regional Soils Sections

M.I.B. 12-8-74

FIGURE 1

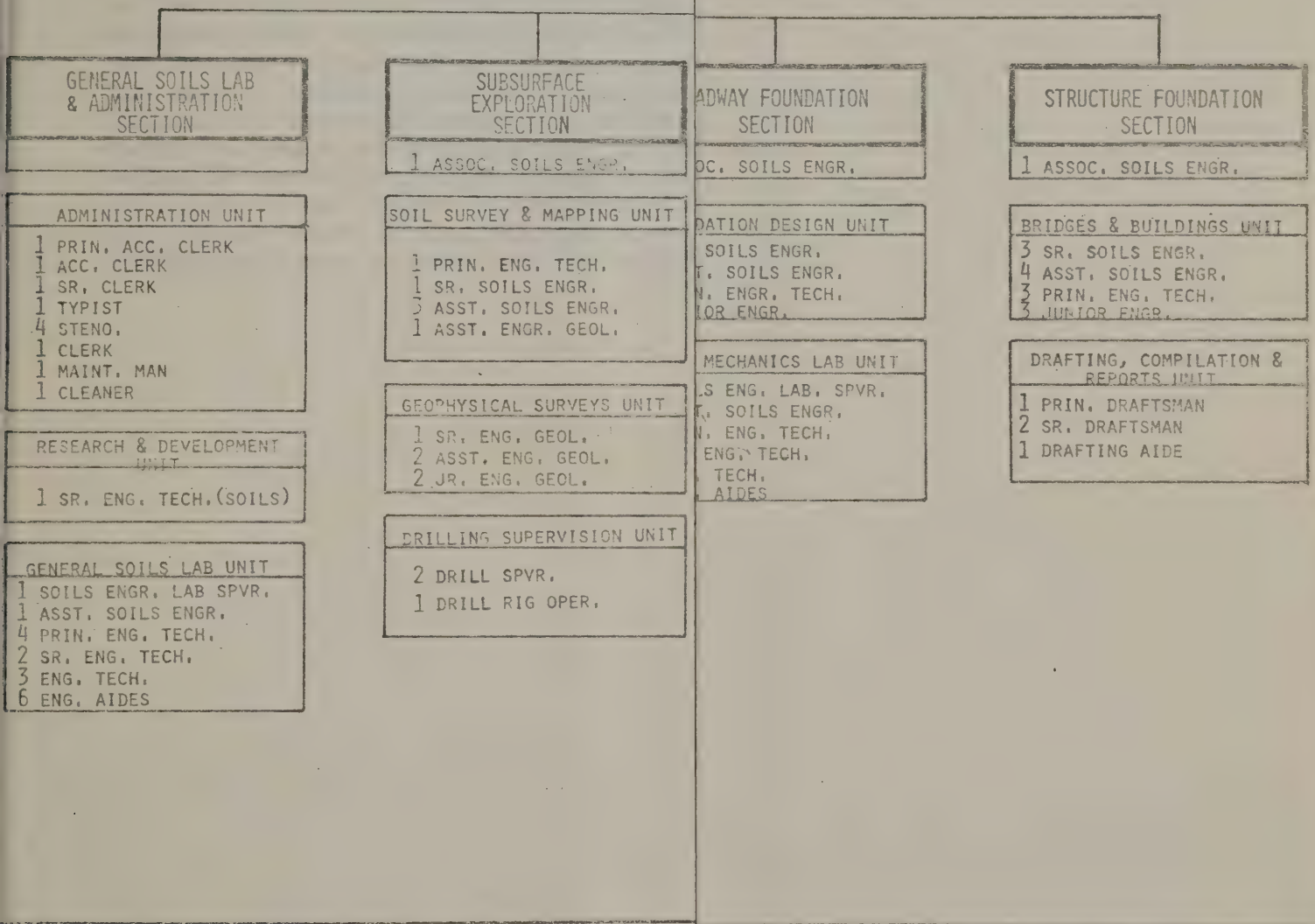
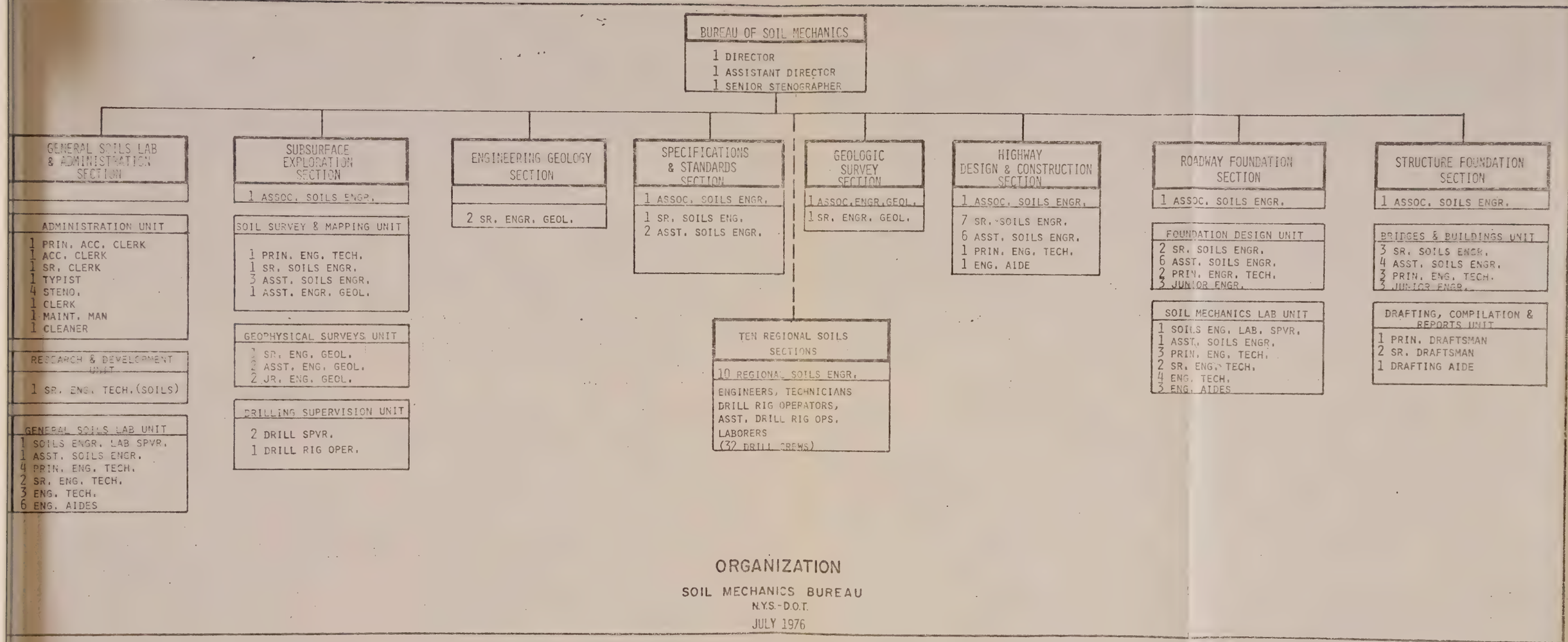

GENERAL SOILS LAB & ADMINISTRATION SECTION
ADMINISTRATION UNIT
1 PRIN. ACC. CLERK
1 ACC. CLERK
1 SR. CLERK
1 TYPIST
4 STENO.
1 CLERK
1 MAINT. MAN
1 CLEANER
RESEARCH & DEVELOPMENT UNIT
1 SR. ENG. TECH. (SOILS)
GENERAL SOILS LAB UNIT
1 SOILS ENGR. LAB SPVR.
1 ASST. SOILS ENGR.
4 PRIN. ENG. TECH.
2 SR. ENG. TECH.
3 ENG. TECH.
6 ENG. AIDES
SUBSURFACE EXPLORATION SECTION
1 ASSOC. SOILS ENGR.
SOIL SURVEY & MAPPING UNIT
1 PRIN. ENG. TECH.
1 SR. SOILS ENGR.
3 ASST. SOILS ENGR.
1 ASST. ENGR. GEOL.
GEOPHYSICAL SURVEYS UNIT
1 SR. ENG. GEOL.
2 ASST. ENG. GEOL.
2 JR. ENG. GEOL.
DRILLING SUPERVISION UNIT
2 DRILL SPVR.
1 DRILL RIG OPER.
ADWAY FOUNDATION SECTION
OC. SOILS ENGR.
DATION DESIGN UNIT
SOILS ENGR.
T. SOILS ENGR.
N. ENGR. TECH.
IOR ENGR.
MECHANICS LAB UNIT
LS ENG. LAB. SPVR.
T. SOILS ENGR.
N. ENG. TECH.
ENG. TECH.
TECH.
AIDES
STRUCTURE FOUNDATION SECTION
1 ASSOC. SOILS ENGR.
BRIDGES & BUILDINGS UNIT
3 SR. SOILS ENGR.
4 ASST. SOILS ENGR.
3 PRIN. ENG. TECH.
3 JUNIOR ENGR.
DRAFTING, COMPILATION & REPORTS UNIT
1 PRIN. DRAFTSMAN
2 SR. DRAFTSMAN
1 DRAFTING AIDE

FIGURE 2



ORGANIZATION

SOIL MECHANICS BUREAU
N.Y.S.-D.O.T.
JULY 1976

FIGURE 2

SOILS PROGRAM OPERATIONS

Established operating procedures are probably one of the more important factors that determines the success and effectiveness of any program. The major input of the Soils Program is into the Department design and construction programs for transportation facilities under the jurisdiction of the Regional Directors. About 70 percent of the Bureau manpower effort is providing specialized technical expertise, laboratory testing, and specialized explorations as input to the Region programs. This work is closely coordinated with the activities of the Region Soils Sections and must meet Region time schedules. Figure 3 shows the operations chart for the Soils Program showing the program activities inside the shaded box, Region Soils on left and the Bureau on the right. The output of the program in the form of reports, test data, inspections, and advisory services are indicated on the outer portion of the chart for the various Region programs and for Main Office organization units.

FOR SOIL

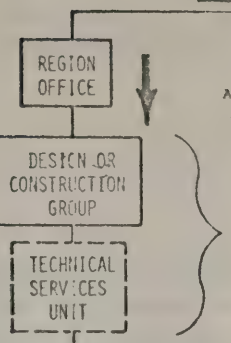


FIGURE 3

REGION PROGRAM	OUTPUT TO REGION PROGRAMS Soils Recommendations Technical Advice & Training Testing Services	REGION SOILS SECTIONS	Provides Special Technical Services Technical Specs & Standards Quality Assurance	DEPARTMENT PROGRAM
PLANNING	Terrain Reconnaisance Report FIS Input Report		To Planning Division To Design Subd., Planning Div. Available to All Units	PLANNING
DESIGN	Project Soils Report		Facilities Design Subd.	DESIGN
CONSTRUCTION	Test Data For Contract Acceptance Inspections Reports		Pavements Subdivision	CONSTRUCTION
MAINTENANCE	Reports, Technical Advisory Service		Maintenance Division Highways & Waterways Subdivisions	MAINTENANCE
TRAFFIC ENGINEERING & SAFETY	Reports, Technical Advisory Service			TRAFFIC ENGINEERING & SAFETY

OPERATIONS CHART
FOR SOILS PROGRAM IN D.O.T. ORGANIZATION

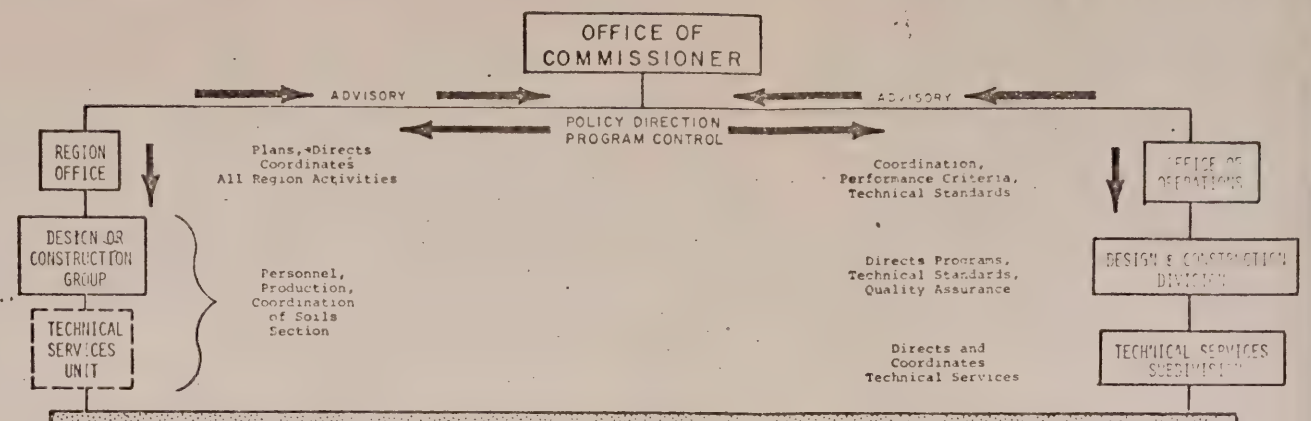


FIGURE 3

SOILS PROGRAM

REGION PROGRAM		REGION SOILS SECTIONS	SOILS MECHANICS BUREAU	DEPARTMENT PROGRAM
	← Future to Region Programs: Soils Recommendations, Technical Advice & Training, Testing Services	PROVIDES TO BUREAU: Work Schedules, Exploration Data, Performance Evaluation →	← TO REGIONS: Special Technical Services, Technical Direction, Technical Standards, Equipment, Supplies	→ Provides: Special Technical Services, Technical Specs. & Standards, Quality Assurance
PLANNING	← Terrain Reconnaissance Report, FIS Input Report	Preliminary Subsurface Explorations →	← Terrain Reconnaissance Report (Water Quality, Erosion); Statewide Pavement Serviceability Survey	→ To Planning Division; → To Location Sect., Planning Div. Available to All Units	PLANNING
DESIGN	← Project Soils Report	Detailed Subsurface Explorations → Highway Design Details: Subbase Design, Undercutting, Granular Slope Protection, Topsoil Sources, Bank & Channel Protection, Granular Material Sources, Subsurface Drainage, Pile Jacking, Temporary Erosion Control, E & P Design Recommendations →	← Reports ← Bureau Design Liaison	Drilling - Technical Direction, Supplies; Geophysical Survey - Seismic; Rock Outcrop Mapping; Abutment Foundation Design; Slope Design - Earth & Rock; Culvert & Pipe Design; Recharge Basin Design; Wall Foundation Design; Water Quality Problems; Well Design - Rest Areas Technical Assistance Pavement Design Standards; Structure Foundations Report; Advance Detail & Final Plan Review; Earthwork Specifications & Standards	→ Publications to the Subj. Matter Committees, Materials Testing Subj. Materials Testing Board.	DESIGN
CONSTRUCTION	← Test Data for Contract Acceptance Inspections Reports	Preconstruction Soils Meeting; Sampling & Testing Granular Materials; Soils Engineers Inspectors; Assist Construction Engineer on Soils Problems →	← Test Data ← Inspections, Reports	Subbase Gravel Testing; Bituminous Stabilized Gravel Testing; Compaction Testing; Topsoil Testing; Project Testing Equipment & Supplies Stone Filling & Rip Rap Inspection; Presplitting & Rock Excavation Inspection; Pile Installation Inspection; Construction Control; Instrumentation - Inspection; Field Construction Problems Structure Pile Length Analysis; Orders-On-Contract Review	→ Materials Division; → Construction Subd.	CONSTRUCTION
MAINTENANCE	← Reports, Inspections, Advisory Service	Borrow Sand Sources; Slope Erosion Treatments; Soil Erosion Control; Groundwater Control; Cut Slope & Embankment Failures; Major Problems →	← Inspections, Reports	Cut Slope, Embankment Stability Problems; Soil Information & Water Quality Problems; Blasting on Rock & Boulder Blasting; Wall Maintenance Problems; Canal Foundation Design	→ Materials Division Drainage & Maintenance Considerations	MAINTENANCE
TRAFFIC ENGINEERING & SAFETY	← Reports, Inspections, Advisory Service	Permits; Review of Soil-Rock and Groundwater Considerations →	← Inspections, Reports	Advisory Service		TRAFFIC ENGINEERING & SAFETY
		POST CONSTRUCTION Performance Evaluation of Constructed Facilities →	← Post Construction Evaluation of Performance of Soils & Structures		→ To Construction & Structure Subd.	

DEVELOPMENT OF MANPOWER-PRODUCTION DATA

Function Codes

A series of codes as shown in the previous Mission Statement section are developed to describe all significant manpower activities involved in the program. The Soils Program has 115 function codes and uses 35 Departmentwide codes mostly defining management and support functions. These codes are recorded on each individual bi-weekly attendance report (AD 73) with the time in hours devoted to each activity. A location code on each time sheet indicates in what organizational unit the work was performed. This information is processed in the Integrated Accounting System and summarized on Program Accomplishment Reports (Management Report 5F) available to program managers. The year-end report covers 26 pay periods.

Production Records

The function code definitions include production reporting units where practical. Examples are test, report, inspections, lineal foot of drilling, and projects. Some codes have no production units. Each section or unit supervisor is responsible for keeping a record of all production for his organization element. We have found this method to be more practical than entering the production data into the Integrated Accounting System.

Manpower-Production Summary

Figure 4 shows the Soil Mechanics Bureau manpower-production summaries. This format was developed to provide for Bureau management an overview of the trends in manpower activity and assignment of personnel. The Bureau summary reflects a 20 percent manpower reduction during the Statewide fiscal crisis in 1975-76.

DESCRIPTION & FUNCTION CODE	PRODUCTION UNIT		5-1976 PRODUCT.	F.Y. 1976-1977 MAN DAYS	F.Y. 1976-1977 PRODUCT.
SURVEYS & EXPLORATIONS					
BORINGS-ENGR'G-STATE FORCES & CONTRACT (E101, E102)	NONE		69	264	76
BORING OPERATIONS (E103, E105-E115)	LIN. FOOT		21	374	21
SUBSURFACE FIELD MEAS. (E116, E124)	INSTALLATION		9	352	7
GEOPHYSICAL SURVEYS (E135, E136)	POINT		1	220	4
ROCK OUTCROP MAPPING (E131)	RDWY MILE		18	597	15
BOREHOLE CAMERA-SURVEY & ANALYSIS (E132, E133)	NO. OF HOLES SURV.				
TERRAIN RECONNAISSANCE (E151-E154, E159)	PROJECT			1,809	
EARTH MATERIAL SURVEY (E161)	PROJECT			8.4	
PAVEMENT SERVICEABILITY SURVEY (E171, E172)	SURVEY MILE				
TOTAL - SURVEYS & EXPLORATIONS		2		4,364	
EQUIVALENT STAFF (MAN YEARS)				21.4	
TESTING					
SOIL IDENTIFICATION (E201, E202)	SAMPLE		488	219	482
SOIL CLASSIFICATION (E203)	SAMPLE		23	89	25
SOIL STRENGTH (E204, E205)	TEST		162	218	20
SOIL CONSOLIDATION (E206), (E210)	TEST		137	51	130
GRANULAR MATERIALS (E221)	SAMPLE		1	23	-
COMPACTION (E222)	SAMPLE		26	32	5
TOPSOIL (E223)	SAMPLE		28	26	26
SOIL STABILIZATION (E224)	SAMPLE		3	24	5
SPECIFIC SURFACE (E225)	SAMPLE		-	13	2
SPECIAL-ENGR'G-DESIGN & EARTHWORK MAT'L (E209,E226)	SAMPLE				
WATER QUALITY (E228)	SAMPLE			795	
EARTHWORK DATA ANALYSIS & REPORTS (E229)	REPORT			3.7	
TOTAL - TESTING		5		2,213	
EQUIVALENT STAFF (MAN YEARS)				792	
ENGINEERING ANALYSES & REPORTS				384	
FACILITY DESIGN					
ROADWAY DESIGN - GENERAL (E301)	PROJECT			170	
PAVEMENT DESIGN (E302)	PROJECT				
ROADWAY FOUNDATIONS - DESIGN (E303)	PROBLEM AREA			157	
ROADWAY FOUNDATIONS - CONSTRUCTION (E304)	PROBLEM AREA			66	
STRUCTURE FOUNDATIONS - DESIGN (E305, E307)	STRUCTURE				
STRUCTURE FOUNDATIONS - CONSTRUCTION (E306, E308)	STRUCTURE			4,282	
CULVERTS & PIPES - DESIGN (E309)	CULVERT OR PIPE			19.8	
CULVERTS & PIPES - CONSTRUCTION (E310)	CULVERT OR PIPE				
RECHARGE BASIN - DESIGN (E311)	BASIN				
GEOL. SURVEY & ANALYSIS-ROCK CUT SLOPES (E312)	CUT/PROJECT				
GEOL. SURVEY & ANALYSIS-STRUCT. FOUNDATIONS (E313)	STRUCTURE				
GROUND WATER SUPPLY INVEST. & ANALYSIS (E314)	PROJECT			2,967	
AIRPORT DESIGN (E315)	PROJECT			3,955	
CANAL FOUNDATIONS (E316)	PROJECT			9,364	
BUILDING FOUNDATIONS & SITE PROBLEMS-DESIGN (E317)	BUILDING			795	
EARTH DAMS - DESIGN (E318)	DAM			4,282	
REVIEW OF DAM DESIGN (WATER RESOURCES COMM.)(E319)	PROJECT				
FOUNDATION OTHER - DESIGN (E320)	PROJECT			21,363	
FOUNDATION PILE DESIGN VERIFICATION (E321)	TEST			90.9**	
RAIL ROADBED INVEST. & DESIGN (E330)	PROJECT/MILES INSP.				
ENVIRONMENTAL CONSIDERATIONS (E341, E342)	PROJECT/REPT.		FACTOR NOT INCLUDED		
COURT OF CLAIMS CASES (E382)	CASE				
ENGINEERING CONSULTATION NOT D.O.T. (E383)	PROJECT				
OTHER ENGINEERING SERVICES (E381, E384)	PROJECT				
SERVICE FOR MATERIALS BUREAU (M SERIES)					
TOTAL - FACILITY DESIGN		8			
EQUIVALENT STAFF (MAN YEARS)					

MANPOWER PRODUCTION REPORT
SOIL MECHANICS BUREAU
(Sources: 5F Report, S.M.B. Production Report)
Prepared MAY 1977

FIGURE 4

DESCRIPTION & FUNCTION CODE	PRODUCTION UNIT	F.Y. 1974-1975 MAN DAYS	F.Y. 1974-1975 PRODUCT.	F.Y. 1975-1976 MAN DAYS	F.Y. 1975-1976 PRODUCT.	F.Y. 1976-1977 MAN DAYS	F.Y. 1976-1977 PRODUCT.
SURVEYS & EXPLORATIONS							
BORINGS-ENGR'G-STATE FORCES & CONTRACT (E101, E102)	NONE	571		536		521	
BORING OPERATIONS (E103, E105-E115)	LIN. FOOT	107		9		62	
SUBSURFACE FIELD MEAS. (E116, E124)	INSTALLATION	32		30		135	
GEOPHYSICAL SURVEYS (E135, E136)	POINT	854	1,530	742	1,332	407	571
ROCK OUTCROP MAPPING (E131)	RDWY MILE	41	10	71	16	25	25
BOREHOLE CAMERA-SURVEY & ANALYSIS (E132, E133)	NO. OF HOLES SURV.	20	2	34	6	6	10
TERRAIN RECONNAISSANCE (E151-E154, E159)	PROJECT	440	50	452	24	597	19
EARTH MATERIAL SURVEY (E161)	PROJECT	278	3	166	5	139	1
PAVEMENT SERVICEABILITY SURVEY (E171, E172)	SURVEY MILE	NEW F.C. 4-1-75		451	31,694	1,075	26,448
TOTAL - SURVEYS & EXPLORATIONS		2,349		2,491		2,967	
EQUIVALENT STAFF (MAN YEARS)		10.9		11.5		13.7	
TESTING							
SOIL IDENTIFICATION (E201, E202)	SAMPLE	896	14,361	919	10,544	598	6,341
SOIL CLASSIFICATION (E203)	SAMPLE	837	1,257	634	910	461	820
SOIL STRENGTH (E204, E205)	TEST	525	570	407	361	287	423
SOIL CONSOLIDATION (E206), (E210)	TEST	733	339	528	180	378	117
GRANULAR MATERIALS (E221)	SAMPLE	1,807	2,428	1,773	1,503	1,133	1,074
COMPACTION (E222)	SAMPLE	198	71	221	191	140	90
TOPSOIL (E223)	SAMPLE	299	584	383	492	248	374
SOIL STABILIZATION (E224)	SAMPLE	500	542	463	363	304	317
SPECIFIC SURFACE (E225)	SAMPLE	56	221	6	31	5	54
SPECIAL-ENGR'G-DESIGN & EARTHWORK MAT'L (E209,E226)	SAMPLE	NEW F.C. 4-1-75		15	638	94	510
WATER QUALITY (E228)	SAMPLE	24	48	-	-	2	-
EARTHWORK DATA ANALYSIS & REPORTS (E229)	REPORT	NEW FUNCTION CODE 4-1-76				305	-
TOTAL - TESTING		5,882		5,349		3,955	
EQUIVALENT STAFF (MAN YEARS)		27.4		24.8		18.3	
ENGINEERING ANALYSES & REPORTS							
FACILITY DESIGN							
ROADWAY DESIGN - GENERAL (E301)	PROJECT	1,858	295	1,953	433	1,826	576
PAVEMENT DESIGN (E302)	PROJECT	71	-	18	-	11	-
ROADWAY FOUNDATIONS - DESIGN (E303)	PROBLEM AREA	1,812	93	2,171	108	1,527	89
ROADWAY FOUNDATIONS - CONSTRUCTION (E304)	PROBLEM AREA	127	23	75	4	181	9
STRUCTURE FOUNDATIONS - DESIGN (E305, E307)	STRUCTURE	2,140	103	2,091	124	1,775	145
STRUCTURE FOUNDATIONS - CONSTRUCTION (E306, E308)	STRUCTURE	314	5	197	32	115	51
CULVERTS & PIPES - DESIGN (E309)	CULVERT OR PIPE	39	4	69	12	92	6
CULVERTS & PIPES - CONSTRUCTION (E310)	CULVERT OR PIPE	10	3	12	3	17	5
RECHARGE BASIN - DESIGN (E311)	BASIN	65	7	104	6	72	2
GEOL. SURVEY & ANALYSIS-ROCK CUT SLOPES (E312)	CUT/PROJECT	131	22	221	20	220	41
GEOL. SURVEY & ANALYSIS-STRUCT. FOUNDATIONS (E313)	STRUCTURE	89	45	114	44	92	43
GROUND WATER SUPPLY INVEST. & ANALYSIS (E314)	PROJECT	164	23	126	23	39	7
AIRPORT DESIGN (E315)	PROJECT	113	7	50	10	51	9
CANAL FOUNDATIONS (E316)	PROJECT	183	6	215	2	127	7
BUILDING FOUNDATIONS & SITE PROBLEMS-DESIGN (E317)	BUILDING	636	60	291	62	286	34
EARTH DAMS - DESIGN (E318)	DAM	21	4	23	2	18	4
REVIEW OF DAM DESIGN (WATER RESOURCES COMM.)(E319)	PROJECT	187	36	91	44	76	15
FOUNDATION OTHER - DESIGN (E320)	PROJECT	315	35	321	19	166	27
FOUNDATION PILE DESIGN VERIFICATION (E321)	TEST	NEW F.C. 4-1-75		115	20	18	-
RAIL ROADBED INVEST. & DESIGN (E330)	PROJECT/MILES INSP.	NEW FUNCTION CODE 4-1-76				200	31
ENVIRONMENTAL CONSIDERATIONS (E341, E342)	PROJECT/REPT.	NEW FUNCTION CODE 4-1-76				161	7
COURT OF CLAIMS CASES (E382)	CASE	41	1	199	16	111	15
ENGINEERING CONSULTATION NOH D.O.T. (E383)	PROJECT	67	-	8	-	12	14
OTHER ENGINEERING SERVICES (E381, E384)	PROJECT	212	59	247	25	352	10
SERVICE FOR MATERIALS BUREAU (M SERIES)							
TOTAL - FACILITY DESIGN		8,595		8,711		7,555	
EQUIVALENT STAFF (MAN YEARS)		39.9		40.3		34.9	

DESCRIPTION & FUNCTION CODE	PRODUCTION UNIT	F.Y. 1974-1975 MAN DAYS	F.Y. 1974-1975 PRODUCT.	F.Y. 1975-1976 MAN DAYS	F.Y. 1975-1976 PRODUCT.	F.Y. 1976-1977 MAN DAYS	F.Y. 1976-1977 PRODUCT.
TECHNICAL DEVELOPMENT							
SPECIFICATIONS & STANDARDS (E351)	SPEC. OR STANDARD	409	31	210	69	164	76
PERFORMANCE EVALUATION (E352)	PROJECT	444	4	258	21	374	21
ENGINEERING MANUALS AND SPECIAL REPORTS (F353)	REPORT OR MANUAL	405	5	527	9	352	7
COMPUTER PROGRAM DEVELOPMENT (E354)	PROGRAM	263	1	273	1	220	4
MAJOR TECHNICAL DEVELOP. PROJECTS (E361-E366)	NONE	1,205	14	1,487	18	597	15
TOTAL - TECHNICAL DEVELOPMENT		2,776		2,871		1,809	
EQUIVALENT STAFF (MAN YEARS)		12.7		13.3		8.4	
TOTAL - ENGR. ANALYSES & REPORTS		11,321		11,582		9,364	
EQUIVALENT STAFF (MAN YEARS)		52.6		53.6		43.4	
INSPECTION							
ROADWAY INSPECTION - GENERAL (E401)	INSPECTION	482	477	430	488	319	482
ROADWAY INSPECTION - STABILIZED MAT'L (E403)	INSPECTION	259	73	194	33	69	25
ROADWAY INSPECTION GEOLOGICAL (E404)	INSPECTION	280	145	378	162	218	20
ROADWAY INSPECTION STONE FILLING & RIP-RAP (E405)	INSPECTION	104	149	97	137	51	130
CONSTRUCTION CONTROL DEVICES (E407)	PROJECT	142	-	152	1	23	-
WATER WELL INSTALLATION (E409)	PROJECT	311	96	104	26	32	5
INSPECTION-OTHER FACILITIES (E402, E408, E429)	PROJECT OR INSP.	52	67	22	28	26	26
DAMS EARTHFN INSPECTION (E421)	INSPECTION	3	-	11	3	24	5
STRUCT. FOUNDATION INSPECT. GEOLOGIC (E430)	INSPECTION	-	-	-	-	13	2
TOTAL - INSPECTION		1,633		1,388		795	
EQUIVALENT STAFF (MAN YEARS)		7.5		6.4		3.7	
SUPPORT							
INTERNAL SUPPORT (STENO., FILING, PURCHASING) (0121, 0125, 0511, 0515, 0366, 0367, 0524)	NOT REPORTED	2,863		2,586		2,213	
EQUIPMENT MAINTENANCE, REPAIR, DESIGN AND CONST. (E104, E134, E137, E173, E227, E506, E507)		811		826		742	
TRAINING (0131-0137)		909		586		384	
COMMUNICATIONS WITH INDUSTRY & PROF. GROUPS (E501, E502)		274		135		170	
CONFERENCES (0138 & 0139)		202		166		157	
SOILS PROGRAM BUDGET (0330) & SPEC. REPRTS (0127)		143		135		66	
TOTAL - SUPPORT		5,202		4,434		4,282	
EQUIVALENT STAFF (MAN YEARS)		24.1		20.5		19.8	
SUMMARY							
SURVEYS & EXPLORATIONS		2,349		2,491		2,967	
TESTING		5,882		5,349		3,955	
ENGINEERING ANALYSES & REPORTS		11,321		11,582		9,364	
INSPECTION		1,633		1,388		795	
SUPPORT		5,202		4,434		4,282	
TOTAL - ALL ACTIVITIES		26,477		25,244		21,363	
EQUIVALENT STAFF (MAN YEARS)		122.5**		116.9**		99.0**	

**BUREAU ADMINISTRATION INCLUDING DIRECTOR & ASS STANT DIRECTOR NOT INCLUDED

MANPOWER PRODUCTION REPORT
SOIL MECHANICS BUREAU
(Sources SF Report, SMB Production Report)
Prepared MAY 1977

FIGURE 4

MANAGEMENT USE OF MANPOWER-PRODUCTION DATA

Budget Justification

This is one of the most important uses of the data. The first example occurred in 1968, when the Department design and construction program was expanding rapidly and increasing responsibilities and activities were assigned to the Bureau. The manpower-production records for the previous two years were analyzed and projected to account for the expanded program. A complete analysis of all Bureau activities indicated that seventeen additional positions were needed. This successful budget presentation would be called Zero Base Budgeting in today's nomenclature.

The second example is a current problem where historic data is being used to justify manpower staffing. In 1971, the Specifications and Standards Section was requested to develop a system to measure the condition of the 15,000 mile State highway system annually in order to develop information to determine priorities for maintenance and rehabilitation actions and to measure the rate of system deterioration for predicting future fiscal needs. The equipment and system were successfully developed and is now operational. The data is being used by various program managers. However the eight people required to staff the operation are misassigned from other Bureau units and manpower-production data will be used in the budget request for new positions.

Productivity Analyses

The information on the summary sheet facilitates analyses to determine man-days of work effort per production unit. This analysis is valid for activities such as testing where the mechanics of the work is constant for each test. However, there are many activities such as Roadway Foundation Design (E311) and Building Foundation Design (E315) where a report can involve one man-day to fifty man-days depending on the complexity of the problem and the manpower required for the analysis. In these cases reliable values of work effort per production unit may be developed by using several years data to average fluctuations. Therefore, analyses of this type must be conducted with judgment.

Manpower Planning

From 1971 to 1976, there was a considerable reduction in staff in most State agencies. During this period the Bureau staff was cut from 145 to 102 people. Although the Department programs decreased, the Bureau received a number of new programs that required personnel reassignments within the organization to meet schedules. Some examples of these new programs are development of erosion control standards, water quality sampling, pile load testing for structure foundations, and the previously described Pavement Serviceability Program. The reports were used to predict manpower needs and to determine where people could be obtained for reassignment.

EVALUATION OF MANPOWER-PRODUCTION DATA

The accuracy of the information developed is determined by the individual employee filling out his time sheet (AD 73). In the Bureau, section and unit heads are responsible for controlling the use of function codes and monitoring each time sheet. The employee is motivated by the knowledge that information on his time sheet will be used in budget preparation and it may help in opportunities for advancement or in today's world a better opportunity to keep his job. Desk audits and reviews of annual reports indicate that the information is 98 to 99 percent accurate which is adequate for management purposes. Larger organizations may not be so successful in developing reliable input. A practical system of function codes is also another element for success.

SUMMARY

Our experience indicates that manpower-production reports are useful in the total management responsibilities of planning, organizing, directing and controlling all program activities. However, it should be recognized as only one of the many tools that must be used by management to achieve program goals and objectives with the desired impact and effectiveness.

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